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**METHODS AND APPARATUS FOR OBTAINING AND DISTRIBUTING  
VOICE MAIL INFORMATION**

**RELATED APPLICATIONS**

5           The present application claims the benefit of  
U.S. Provisional Application S.N. 60/269,338, filed on  
Feb. 16, 2001.

**FIELD OF THE INVENTION**

10           The present invention is directed to  
communications systems and, more particularly, to methods  
and apparatus for obtaining and distributing voice  
message status information and to controlling voice  
message systems.

15           **BACKGROUND OF THE INVENTION**

20           Voice message systems (VMSs), e.g., answering  
machines and voice mail systems, are commonplace in the  
modern communications oriented world.

          Most VMSs allow a user to obtain message status  
information by calling the voice messaging system and  
then entering a mailbox (or account) identifier, a  
password and/or control signals, e.g., DTMF tones. The

retrieval of message status information in this matter represents a polling operation wherein the VMS is periodically contacted and checked for waiting message information.

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While polling a VMS for message waiting information is acceptable in many applications, e.g., in the case of home answering machines, a better approach is to provide a user of a VMS a positive indicator of a waiting message without the user having to check for the message. A frequently encountered example of such an indicator is a message waiting light on a telephone which is activated when a message is left for a VMS user and deactivated when the message is accessed or deleted.

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Centrex is a telephone service whereby a telephone company associates several independent telephone lines together to provide PBX type functionality, e.g., telephone extension dialing, call forwarding, etc. Centrex features are provided through control of telephone lines and calls using software and a switch located at a telephone central office. For each Centrex subscriber, a separate call processing record is maintained and telephone services are provided according to the information in the call processing record.

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Voice mail is sometimes provided as a Centrex service. To provide voice mail to Centrex subscribers, a voice mail system is often located in a telephone office

and coupled to the central office switch used to service Centrex subscribers.

A signaling protocol, referred to as the Simplified Message Desk Interface (SMDI), described in Telecordia Technologies document titled "Simplified Message Desk Interface (SMDI)", Generic Requirements GR-283-CORE, Issue 1, Nov. 1999 was developed to support basic signaling of information between a message storage and retrieval system (MSRS), e.g., a voice message system (VMS), and a stored program controlled switching (SPCS) system such as a central office (C.O.) switch of the type used to provide Centrex service. The SMDI interface uses Frequency Shift Keying (FSK), Phase Shift Keying (PSK) and/or other analog signaling techniques for transmission of information according to an asynchronous serial data transmission protocol. In accordance with the SMDI protocol each word of a SMDI message consists of a start bit (space), a 7-bit standard ASCII character, an even parity bit and a stop bit (mark).

Fig. 1 illustrates a known prior art communications system 10. The communications system 10 includes a public switched telephone network 40, a business premise 23, and a plurality of residential premises 32, 32', and the Internet 18. The business premise 23 includes multiple offices 24, 24'. Each office includes a computer 26, 26'. Computers 26, 26' are coupled together and to the Internet 18 by a local

area network (LAN) 25. The offices 24, 24' also include telephones 28, 28' coupled to a first C.O. switch 48 of the PSTN 40. Telephones 34, 34', in residential premises 32, 32', are coupled to a second C.O. switch 60 of the PSTN 40.

The first and second C.O. switches 48, 60 are located in first and second central offices 42, 44 which are coupled together by a high bandwidth communications channel 56, e.g. a fiber optic link. The PSTN 40 includes a service control point (SCP) 46 which stores customer information, e.g., Centrex call processing records (CPRs), used to provide telephone services to subscribers. The SCP 46 is coupled to the first and second C.O. switches 48, 60 via data lines 43, 45.

In order to provide voice messaging services to Centrex service subscribers coupled to the first C.O. switch 48, a voice messaging system (VMS) 50 is coupled to the C.O. switch 48 via a voice channel 54 and a SMDI link 52. Calls to VMS service subscribers which go unanswered for a preselected period of time are supplied to the VMS 50 where the caller is provided the opportunity to leave a message for the called party. The SMDI link 52 is used to convey call data, in the form of SMDI history messages, from the C.O. switch 48 to the VMS 50. The SMDI link 52 is also used to convey message waiting indicator (MWI) control messages from the VMS 50 to the C.O. switch 48.

In particular, when an unanswered call is delivered to the VMS 50, the C.O switch 48 transmits a SMDI call history message to the VMS over the SMDI link

5 52. Fig. 2 illustrates the format for a standard SMDI history message 200.

The call history message 200 begins with the alphabetic characters MD 202. A 7-digit message line identifier (MLI) 204 follows. The MLI 204 identifies the line to which an incoming call is terminated. It can be, e.g., a 7-digit directory number (DN) assigned to the PSTN or a 7-digit number made up of multi-line hunt group (MLHG) identifier and MLHG position identifier. MLI 204

10 is followed by a 1 character call type identifier 206 which indicates the reason the call was directed to the VMS. A 10-digit forwarding DN 208 is included in the message 200 when the call has been forwarded. Thus, the forwarding DN 208 is omitted in the case of direct calls.

15 A space 209 separates the forwarding DN 208 from a calling DN number 210. The calling DN 208 is followed by a space and a 1 character calling presentation status field 214. The field 214 is followed by another space 216. A calling name/presentation status field 218 is

20 used to provide the name of the calling party which is obtained when available using known techniques. Some of the information fields may be omitted from the call history message 200 depending on the nature of the call

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being connected to the VMS 50 and the availability of information to populate the fields.

Fig. 3 illustrates the format of a SMDI MWI control message 300. The message 300 includes an activation request identifier field 302, a space 304 and a subscriber directory number field 306. The activation request identifier field 302 includes the characters OP or RMV to indicate whether the message waiting indicator should be activated ("operated") or de-activated ("removed"). The subscriber DN field includes a 10-digit directory number which is used to indicate the subscriber whose message waiting indicator is to be controlled. SMDI MWI control messages 300 are terminated by a "!" and a Control D character (not shown).

Use of voice messaging IPs such as the VMS 50 is not limited to Centrex applications. The VMS 50 can be used to provide voice messaging services to residential telephone service customers such as users of telephones 34, 34'. Unfortunately, most residential voice messaging service subscribers lack telephones with message waiting lights which are capable of being activated by a C.O. switch.

One of the advantages of Centrex is that it can be used with standard telephones thereby allowing businesses to avoid the investment in more costly phones which support features such as message waiting lights.

Accordingly, many business subscribers to voice messaging services provided by telephone companies find themselves confronted with having to call the VMS 50 to check for messages even though the VMS 50 supports a SMDI link 52 to the C.O. switch 48.

In view of the above, it becomes apparent that there is a need for improved methods and apparatus notifying voice messaging service subscribers of waiting messages. It is desirable that at least some notification methods be supported which do not require a subscriber to poll a VMS to be notified of waiting messages. It is also desirable that at least some notification methods be supported which can be used with existing voice messaging systems, e.g., systems which support the use of SMDI. It is further desirable that new message notification methods and apparatus not interfere with existing C.O. notification via the control of message waiting lights on telephones which support such functionality.

#### SUMMARY OF THE INVENTION

The present invention is directed to methods and apparatus for obtaining and distributing voice message status information and to controlling voice message systems.

In accordance with the present invention, SMDI messages between a stored program controlled switching system (SPCS), e.g., central office switch, and a message storage and retrieval (MSR) system, e.g., voice message system (VMS), are monitored by a SMDI message server of the present invention.

The SMDI message server detects SMDI messages without interfering with the communication of the messages between the C.O. switch and VMS. The messages are processed and used to generate either E-mail notifications of received messages which are forwarded to a user of the VMS or to supply message status information to a voice message retrieval and forwarding system using IP messaging including IP packets instead of SMDI FSK or PSK signaling. The IP messages generated and transmitted to a VMRAF system may include information from both SMDI MWI control messages and SMDI history messages. In this manner, the VMRAF system can be supplied with information on the identity of the party who left a message which might not be available directly from the VMS at the time the message is retrieved by the VMRAF system.

In accordance with the present invention information for SMDI message server users, and/or VMRAF service subscribers, is stored in a service control point (SCP) and downloaded to the VMRAF system and SMDI message server. The subscriber information downloaded from the SCP to the SMDI message server may include the E-mail



address of the subscriber, the subscriber's DN, information on whether or not the subscriber is a VMRAF service subscriber and, for VMRAF service subscribers, the IP address of the VMRAF system.

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Information downloaded from the SCP to a VMRAF system may include the DNs of VMRAF service subscribers and the E-mail address to which voice messages in the form of audio files may be forwarded using IP packets.

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Since the SMDI message server and VMRAF system of the present invention can be used without interfering with the normal operation and SMDI messaging of known voice messaging systems, the SMDI message server and VMRAF system of the present invention can often be added to existing communications systems without the need to make expensive and costly modifications to existing hardware.

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Various additional features and advantages of the present invention will be apparent from the detailed description which follows.

#### **BRIEF DESCRIPTION OF THE DRAWINGS**

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Fig. 1 illustrates a known communications system which includes a SMDI link for providing a C.O. switch with message waiting status information.

Fig. 2 illustrates the format of a SMDI history message.

5 Fig. 3 illustrates the format of SMDI MWI control messages.

10 Fig. 4 illustrates a communications system implemented in accordance with the present invention, which supports advanced voice message notification and retrieval features.

15 Fig. 5 illustrates a set of exemplary Centrex call processing records which may be used in the system of Fig. 4.

20 Fig. 6 illustrates a SMDI message server implemented in accordance with the present invention.

25 Fig. 7 illustrates a set of subscriber information which may be used by the SMDI message server of Fig. 6.

Fig. 8 illustrates a SMDI message server routine used for providing SMDI information using IP messages.

Fig. 9 illustrates a voice message notification E-mail generated in accordance with the present invention.

Figs. 10 and 11 illustrate IP messages including SMDI information generated in accordance with the present invention.

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#### DETAILED DESCRIPTION

As discussed above, the present invention is directed to methods and apparatus for obtaining and distributing voice message status information and to controlling voice message systems.

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Fig. 4 illustrates a communications system 400 implemented in accordance with the present invention. Various elements of the system 400 may be implemented using elements which are the same as, or similar to, the elements of the known system 10. Such elements are identified in Fig. 4 using the same names and reference numbers as used in Fig. 1. For the purposes of brevity, such elements will not be described again in detail.

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As illustrated in Fig. 4, the communication system 400 includes the Internet 18, business premises 23, residential premises 32, 32', the public switched telephone network (PSTN) 440, and a voice message retrieval and forwarding (VMRAF) system 420 which are coupled together as illustrated.

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The PSTN 440 includes a service control point (SCP) 446 which is coupled to first and second signal transfer points 442, 444. The SCP 446 includes a set 447 of Centrex subscriber call processing records. The call processing records, in accordance with the present invention, include voice message notification information, as well as other information. Fig. 5 illustrates an example of the set 447 of call processing records.

As illustrated in Fig. 5, the set 447 includes a call processing record 501, 501' for each one of the N Centrex subscribers serviced by SCP 446. Each call processing record includes a Centrex customer identifier 502, 502', the subscriber's directory number 504, 504' and a set of service information 506, 506'. In accordance with the present invention, the service information includes information 510, 510' indicating whether or not the subscriber is a VMS service subscriber.

In addition, for VMS service subscribers, a VMS identifier 512, 512' is included which indicates the VMS assigned to provide voice messaging services to the subscriber. Also included in the service information 514, 514' is information which indicates whether the Centrex subscriber is also a voice message retrieval and forwarding (VMRAF) service subscriber. For VMRAF service subscribers, VMRAF system information 516, e.g., the IP

address of the VMRAF system which provides services to the subscriber, is included in the service information 506. Also included in each CPR is an E-mail address 518 where the VMRAF system can E-mail voice messages and/or  
5 E-mail notifications of waiting voice messages can be sent by the SMDI message server.

Referring once again to Fig. 4, STP 44 includes a central office switch 60 as in the known system 10.  
10 However, STP 442 is implemented in accordance with the present invention, and includes a C.O. switch 448, a voice messaging system (VMS) 50 and a SMDI message server 460 and an RS-232 tee 455.

15 Tee 455 is used to tap the SMDI link comprising segments 452, 456 between VMS 50 and C.O. switch 448 without interfering with communications over the SMDI link. Thus, by way of tee 455 and segment 454, the SMDI message server 460 is supplied with the SMDI messages  
20 communicated between VMS 50 and C.O. switch 448. The SMDI message server 460 uses the received SMDI messages to provide E-mail notifications of voice messages to voice messaging service subscribers who do not subscribe to the VMRAF service. It also uses the received SMDI  
25 messages to provide message information to the VMRAF system 420 as will be discussed below.

In the Fig. 4 embodiment, the SMDI message server 460 is shown as being coupled directly to the LAN

25 thereby allowing the SMDI message server 460 to send  
E-mails to computers 26, 26'. In addition, the SMDI  
message server is coupled to the Internet thereby  
permitting E-mails to be sent via the Internet 18 to,  
5 e.g., computers 33, 33'. The Internet 18 provides a  
connection that is well suited for sending E-mails to  
customers who are not directly coupled to an intranet  
such as a corporate LAN.

10 With regard to VMRAF service subscribers the  
SMDI message server 460 forwards SMDI message information  
to the VMRAF system 420 so that the system 420 can  
receive SMDI message information by way of the Internet  
or an intranet in the form of IP messages.

15 SCP 446 is coupled to the SMDI message server  
460, the VMRAF system 420, VMS 50 and C.O. switches 448  
and 44 via data network connections 460, 462, 464, 466  
and 468, respectively. Thus, the SCP 446 can provide  
20 each of these devices with relevant subscriber  
information and configure them to provide services to  
individual Centrex customers as specified by each  
subscriber's CPR information.

25 In one embodiment, the SCP 446 provides the  
VMRAF system 420 with E-mail address information and VMS  
information for Centrex subscribers who are to be  
provided with VMRAF service. In addition to providing E-  
mail information to the VMRAF system, for each VMRAF

service subscriber, the SCP 446 provides the SMDI message server 460 with the VMRAF service subscriber's directory number and the IP address of the VMRAF system 420 to which SMDI message information is to be forwarded by the server 460.

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With regard to VMS subscribers who do not subscribe to VMRAF service, the SCP 446 provides the SMDI message server 460 with directory number and E-mail address information so that the SMDI message server 460 can send them E-mail notifications of voice messages.

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The VMRAF system 420 may be the same as, or similar to, the VMRAF system described in U.S. Patent Application S.N. \_\_\_\_\_, titled "METHODS AND APPARATUS FOR IMPLEMENTING VOICE MESSAGING USING E-MAIL", filed on even date herewith and hereby expressly incorporated by reference. The VMRAF system 420 has the ability to retrieve voice messages from one or more voice messaging systems and forward the voice messages to a subscriber using IP packets, e.g., as E-mail file attachments. In some embodiments, the VMRAF system 420 maintains a local store of retrieved and forwarded voice messages in the event that a subscriber wishes to access the messages by phone by calling the VMRAF system 420.

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In accordance with the present invention, the VMRAF system 420 is provided with SMDI message information in the form of IP messages transmitted from

SMDI message server 460. Providing the VMRAF system 420 with SMDI message information avoids the need for the VMRAF system to poll the VMS 50 to determine when messages are waiting for a subscriber. The message server 460 supplies the VMRAF system with calling party information, such as the calling party's name and/or telephone number (directory number). Such information may not be directly available from the VMS 50 at the time a voice message is retrieved by the VMRAF system 420.

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The VMRAF system 420 responds to the receipt of a SMDI OP MWI message information from the SMDI message server 460 by accessing the VMS 50, retrieving the message corresponding to the DN indicated in the OP MWI message information and forwarding the retrieved message to the subscriber, e.g., using the subscriber's E-mail address. In the case where SMDI history message information is received in addition to the SMDI OP MSI message information, the VMRAF system 420 will include, assuming the presentation status indicator permits presentation of the information, received calling party name and telephone number information in the E-mail message forwarding a retrieved voice message.

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The VMRAF system 420 responds to the receipt of SMDI RMV MWI message information by deleting any locally stored messages, retrieved from the VMS 50, that correspond to the subscriber identified by the DN number included in a SMDI RMV MWI message.



The SMDI message server 460 of the present invention will now be described in detail with reference to Fig. 6. The SMDI message server 460 includes a  
5 network interface card (NIC) and/or modem 602, input/output (I/O) interface 606, CPU 604, and memory 608 which are coupled together by bus 603. A display device 610 and input device, e.g., keyboard 612, is coupled to the other components of the SMDI message server via I/O  
10 interface 606.

The NIC/modem 602 couples the SMDI message server 460 to the Internet 18 and/or one or more intranets. The connection between the SMDI message  
15 server 460 and SCP 46 is an example of one intranet to which the NIC/modem 602 is coupled. The NIC/modem 602 allows the SMDI message server 460 to send and receive information over IP based networks such as the Internet 18. Via NIC/modem 602 and the use of IP packets to  
20 convey information, the SMDI message server 460 forwards E-mail notification of voice messages to service subscribers and sends SMDI message information to the VMRAF system 420.

25 In addition to allowing a system administrator to input and view SMDI message server information by way of devices 610, 612, the I/O interface 606 allows the SMDI message server to receive and, optionally, send, SMDI messages over the SMDI link connecting the C.O.

switch 448 to VMS 50. To support SMDI link  
functionality, the I/O interface includes an FSK and/or  
PSK signal decoder and, in the case where SMDI signals  
are to be generated, an SFK and/or PSK signal encoder as  
well.

Memory 608 includes a SMDI message to IP/E-mail  
conversion routine 622 and E-mail routine 620, VMS  
subscriber information 624 and a SMDI message store 626.  
The CPU 604 controls operation of the SMDI message server  
460 under the direction of one or more of the routines  
622, 620 stored in the memory 608.

As discussed above, some or all of the  
information in the set of VMS subscriber information 624,  
may be supplied by the SCP 446. Fig. 7 illustrates an  
exemplary set of VMS subscriber information 626. The set  
of subscriber information includes an information record  
701, 701' for each of the N subscribers serviced by the  
server 460. For purposes of explanation the information  
record 701 for the first subscriber will be discussed.  
Similar information is maintained for each of the N  
subscribers.

The information 701 stored for the first  
subscriber includes a message line identifier 702 and a  
subscriber DN 704. This information allows the server to  
associate SMDI messages with a particular subscriber by  
comparing the MLI or a DN included in a received SMDI

message to the information in the subscriber database 626. Subscriber information 701 also includes a field 706 which indicates whether or not the subscriber is a VMRAF service subscriber. If the subscriber is a VMRAF service subscriber, another field 708 includes information, e.g., the IP address, of the VMRAF system 420 assigned to service the subscriber. The subscriber information 701 also includes subscriber IP routing information 710, e.g., the E-mail address or IP address to be used for sending E-mail messages, such as notification of voice messages, to the subscriber.

The SMDI message to IP/E-mail conversion routine 622 uses the subscriber information to determine where to send SMDI message information and in what format the information is to be transmitted, e.g., as a message to a VMRAF system 420 or as an E-mail notification to a subscriber.

Fig. 8 illustrates an exemplary SMDI message to IP/E-mail message conversion routine 622. The routine 622 begins in step 802 when it is executed by the SMDI message server's CPU 604. Operation proceeds from step 802 to step 804, wherein the set of subscriber information 626 is accessed, e.g., to identify the subscribers who are to be serviced. Then in step 806, the server 460 monitors the SMDI communications link between the VMS 50 and C.O. switch 448 for SMDI messages.

In step 808 a determination is made as to whether or not a SMDI message was detected. If a SMDI message is detected in step 808, operation proceeds to step 810. However, if no SMDI message is detected in  
5 step 808, operation proceeds once again to monitoring step 806. In step 810, a determination is made as to whether the detected SMDI message is a SMDI history message (HM) or a SMDI message waiting indicator (MWI) message.

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If the received message is a SMDI history message, operation proceeds to step 816 wherein the history message is stored in SMDI message store 626 for future use. Operation proceeds from step 816 to  
15 monitoring step 806.

If the received message is determined in step 810 to be a MWI control message, operation proceeds to step 812 wherein the subscriber information 624 is  
20 accessed using the DN included in the MSI control message. In step 812, a determination is made as to whether the subscriber to whom the DN corresponds uses a VMRAF system, which should receive the SMDI message, or if the subscriber is to receive an E-mail notification of  
25 waiting messages.

If the subscriber is to receive E-mail notifications of waiting messages, operation proceeds to step 814 wherein a determination is made as to whether

the received SMDI message is an operate (OP) or remove (RMV) message. If the message is a SMDI RMV message, no E-mail notification needs to be sent to the subscriber and operation proceeds to step 815. In step 815, the HM corresponding to the RMV message, as determined by the DN included in the RMV message, is deleted from the SMDI message store 626 prior to operation returning once again to monitoring step 806.

10                If an OP message was received, operation proceeds from step 814 to step 816 wherein the stored SMDI history message corresponding to the received OP message, as indicated by the DN in the OP message, is retrieved from the HM store 626. After retrieval, the  
15                retrieved HM is deleted from the store in step 818. Then, in 820, the retrieved HM is used to generate an E-mail notification to the subscriber indicated by the OP DN that a voice message was received. The E-mail notification message may include information obtained  
20                from the retrieved history message, e.g., the name and telephone number of the calling party as well as subscriber information such as the E-mail address of the subscriber which is obtained from the subscriber information 626.

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Referring now to Fig. 9, an example of an E-mail notification message 900 is shown. The message 900 includes in the TO: field 902 the E-mail address of the VMS subscriber. In the message field 904, the message

900 includes the name of the party who left the message, Joe Block, which is obtained from the HM's calling name field 218 and the calling party's telephone number which is obtained from the HM's call DN field 210. Date and  
5 time information included in the message 900 may be generated from an internal clock/calendar maintained by the SMDI voice message server.

After generating the E-mail message, in step  
10 821, the E-mail notification message is transmitted to the service subscriber using E-mail routine 620 and the Internet or an intranet. Once the E-mail notification is transmitted, operation returns to monitoring step 806.

15 If in step 812 it was determined that the subscriber identified by the DN in the received MWI control message is a VMRAF service subscriber, operation proceeds from step 812 to step 822. In step 822 a  
20 determination is made as to whether an OP or RMV MWI control message was received.

If an RMV MWI message is received, in step 826  
an IP message which includes the information from the received RMV message is generated. The IP message  
25 includes the IP address of the VMRAF system used by the subscriber identified by the RMV message's DN. In addition, the message includes one or more IP packets used to convey the RMV MWI message information. Fig. 10 illustrates an exemplary message 1000 which includes

VMRAF IP routing information 1002 and RMV MWI information as the payload 1004.

5           Once the IP message 1000 is generated in step 826, operation proceeds to step 828.

10           If in step 822 it is determined that an SMDI OP MWI message was received, operation proceeds to step 830 wherein the HM corresponding to the OP message is retrieved from the HM store 626. Then, in step 832, the retrieved HM is deleted from the HM store 626. From step 832 operation proceeds to step 834 wherein an IP message directed to the VMRAF system 420, used by the subscriber identified by the OP message DN, is generated.

15           Fig. 11 illustrates an exemplary IP message 1100 generated in step 834. The message 1100 includes VMRAF information 1102, e.g., the IP address of the VMRAF system 420, and a payload 1104 including history message information 1106 and OP MWI message information 1108.

20           The payload information may be transmitted as one or more IP packets and may include all or only some of the HM and OP MWI information.

25           From step 834 operation proceeds to step 828 wherein the generated IP message is transmitted to the VMRAF system, e.g., over the Internet 18 or an intranet. Operation proceeds from step 828 to monitoring step 806.

While the Fig. 8 system uses both history message and MWI control messages, a simplified system can be implemented which does not use the SMDI history message. In such a case, the VMRAF system 420 would be forwarded SMDI OP and RMV MWI message information but not SMDI HM information. Also, in such an embodiment, a VMS subscriber who did not use VMRAF system services would be notified by E-mail of a waiting message, but without the identity of the party who left the message being included in the E-mail notification.

In response to OP MWI message information, the VMRAF system 420 will retrieve and forward waiting voice messages as discussed above. In response to the RMV MWI message information the VMRAF system 420 will delete any locally stored copy of a forwarded message corresponding to the subscriber indicated by the DN in the RMV MSI message.

Numerous variations on the above described methods and apparatus are possible without departing from the scope of the invention. For example, the functionality of the VMRAF system can be combined with that of the SMDI message server to create a system which is directly responsive to SMDI messages communicated between a C.O. switch and VMS coupled thereto.